

# **Monitoring Stratospheric Intrusions over North America using NCEP GFS Products**

**Craig S. Long**  
*NOAA/NWS/NCEP*  
*Climate Prediction Center*

# Stratospheric Intrusions

- Stratospheric Intrusions (SI) are:
  - Folds in the tropopause following atmospheric fronts
  - Associated with rapid cyclogenesis
  - Bring dry, ozone rich stratospheric air down into tropospheric altitudes
  - At flight levels commercial aircraft fly through these SI
  - Cabin levels of ozone can exceed 100/250 ppbv guidance from FAA
  - Most SI do not reach the surface
  - Occasionally, an SI is 'strong' enough to reach the surface bringing higher amounts of ozone than ambient levels which could exceed EPA limits.
  - Also generate strong, dry winds which can be problematic for wildfires
- Monitoring SI is important for these situations.
- The NCEP GFS provides output that can help monitor SI and provide forecasts with reasonable accuracy and resolution.

# Stratospheric Intrusion Monitoring

- Parameters used to monitor and forecast SI are:
  - 2 PVU height
    - 2 PVU is commonly associated with the dynamic height of the tropopause
  - PV on the 320K surface
    - The 320K isentropic surface (only isentropic surface post processed by the GFS)
  - Tropopause height
    - NMC thermal definition related to lapse rate  $< 2^{\circ} \text{ C/Km}$
    - May have multiple occurrences in the vertical, lowest altitude is used.
  - Total Column Ozone
    - In tropopause depressions the total column ozone may be high
  - Ozone mixing ratio (parts per billion by volume)
    - Ozone amount at various pressure levels in the upper troposphere
    - GFS does not post process O3MR at lower levels.

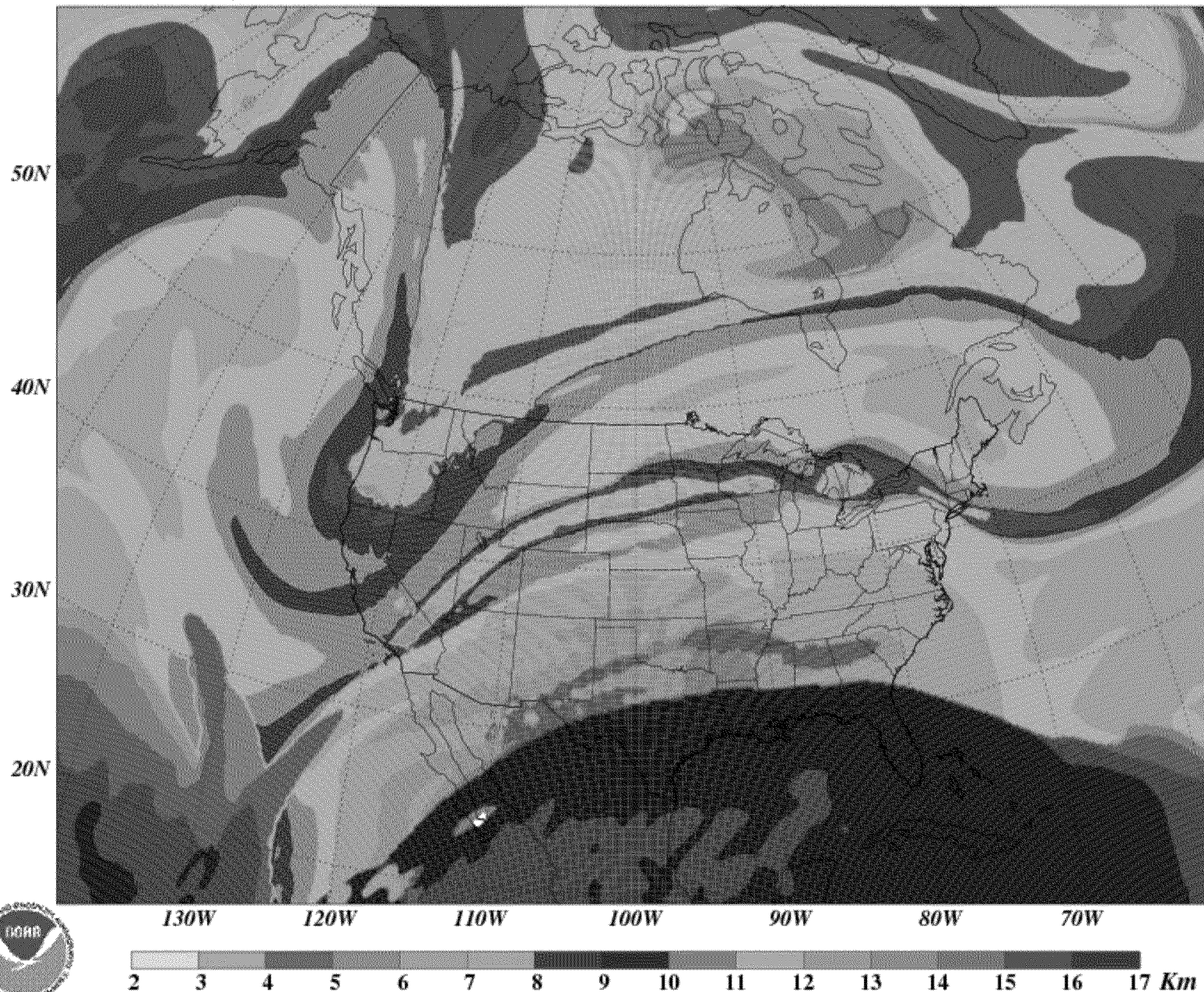
[http://www.cpc.ncep.noaa.gov/products/stratosphere/strat\\_int/](http://www.cpc.ncep.noaa.gov/products/stratosphere/strat_int/)



# GFS 2-PVU Heights

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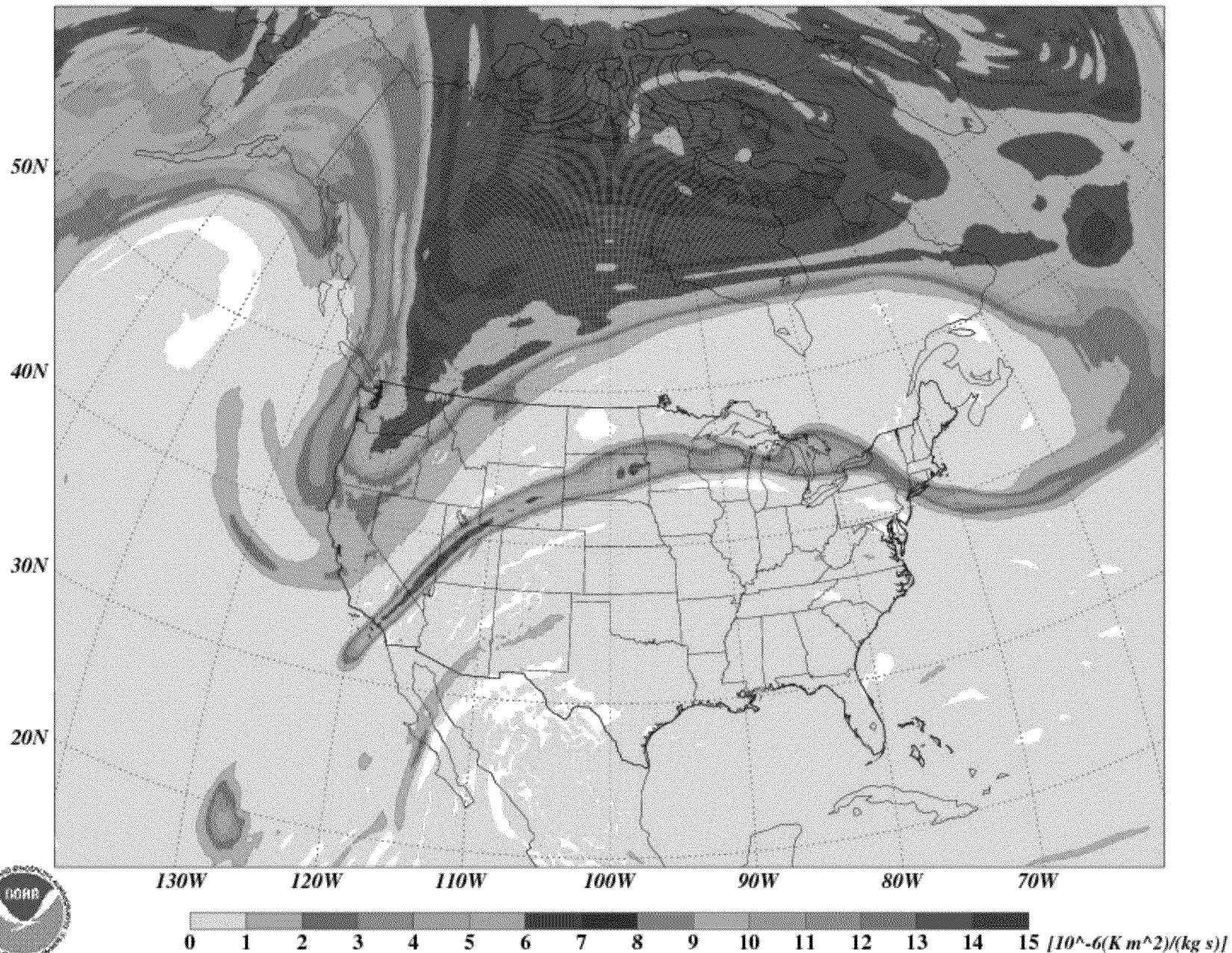
Min value = 3.2, Max value = 19.1



# GFS Potential Vorticity on 320K Surface

Min value = -2.7, Max value = 9.1

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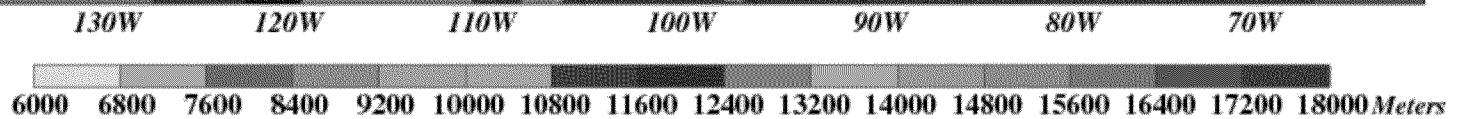
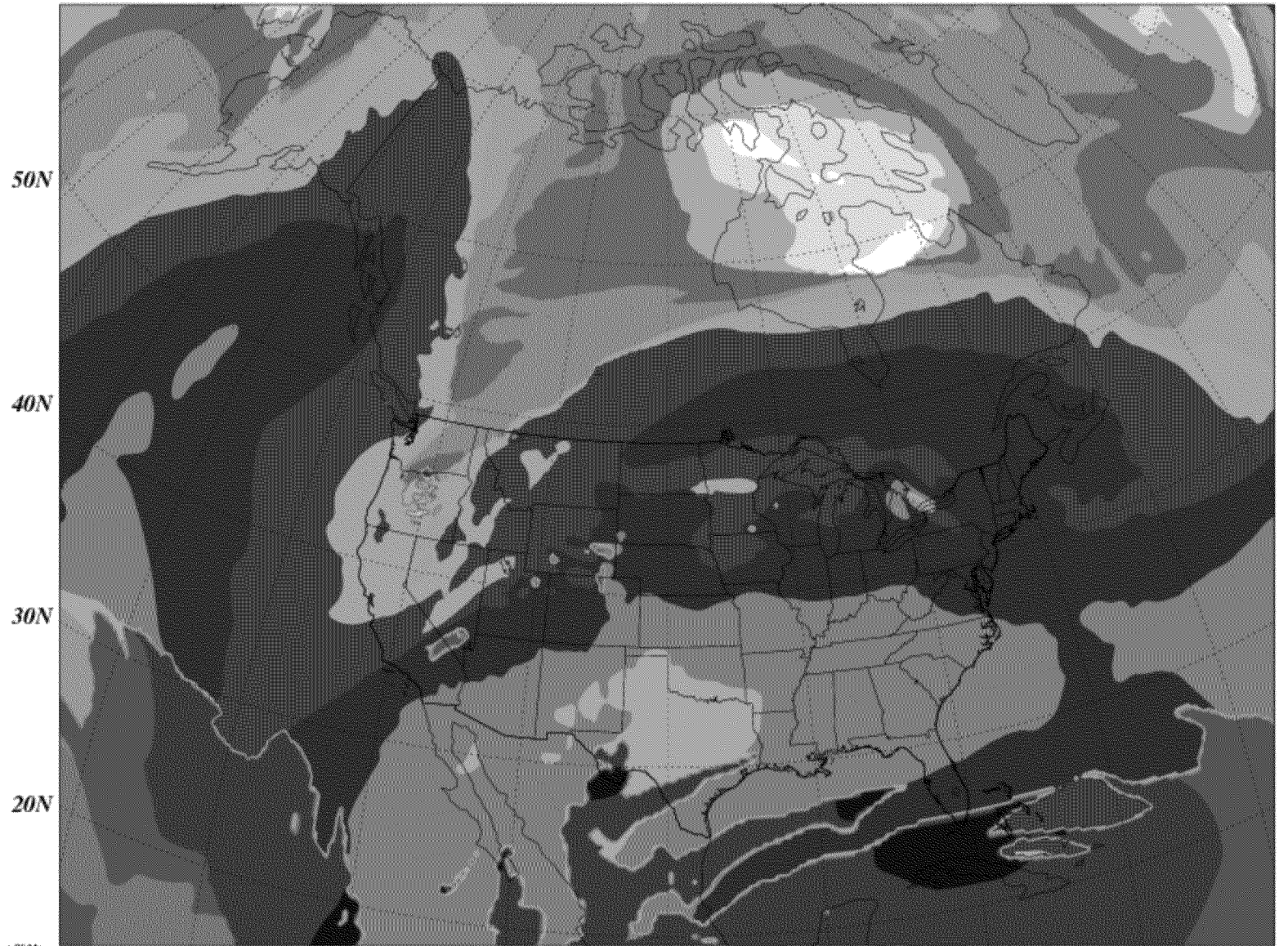




# GFS Tropopause Height

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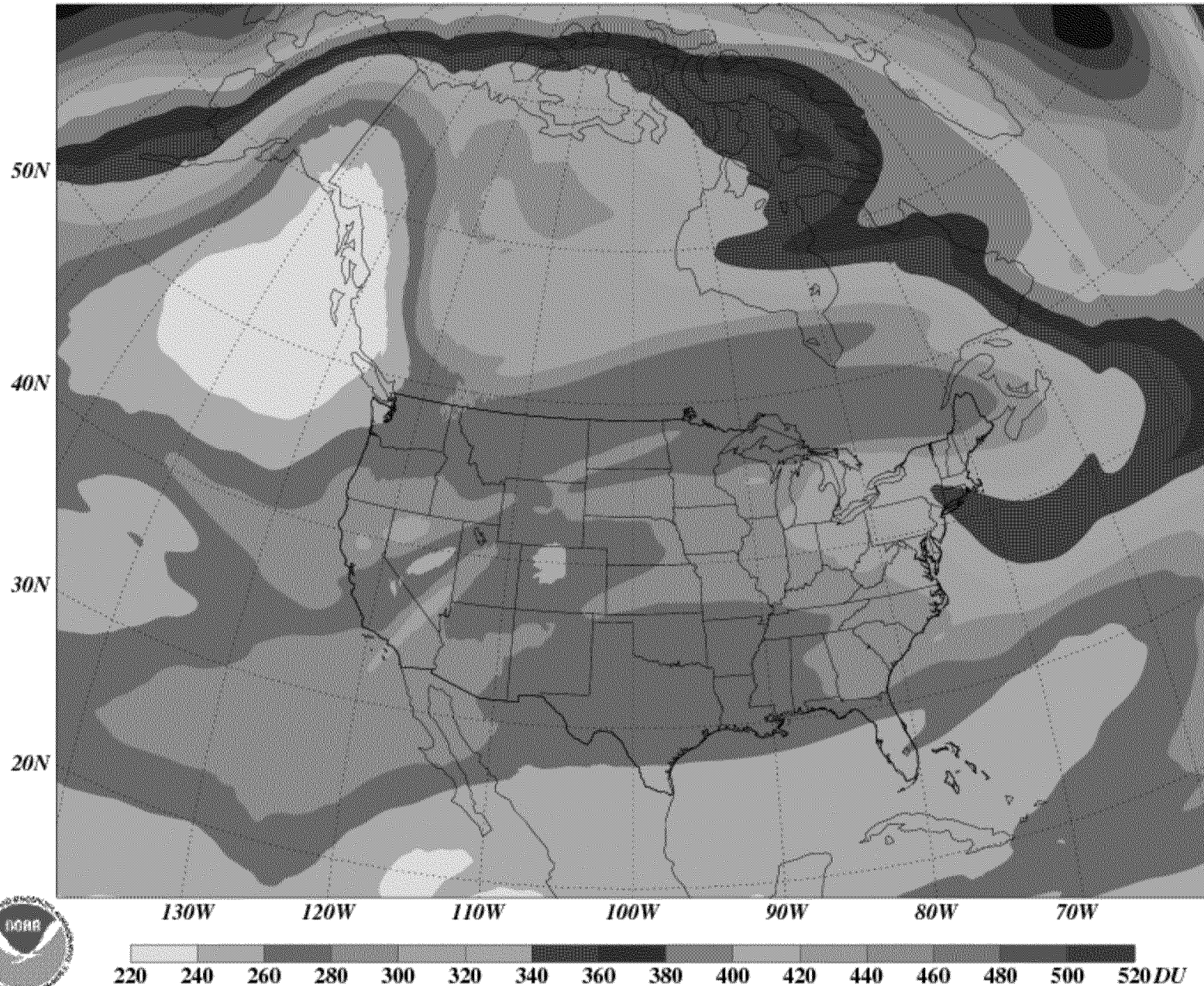
Min value = 4970.3, Max value = 18615.1



# GFS Total Columnn Ozone

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Min value = 220.8, Max value = 531.3

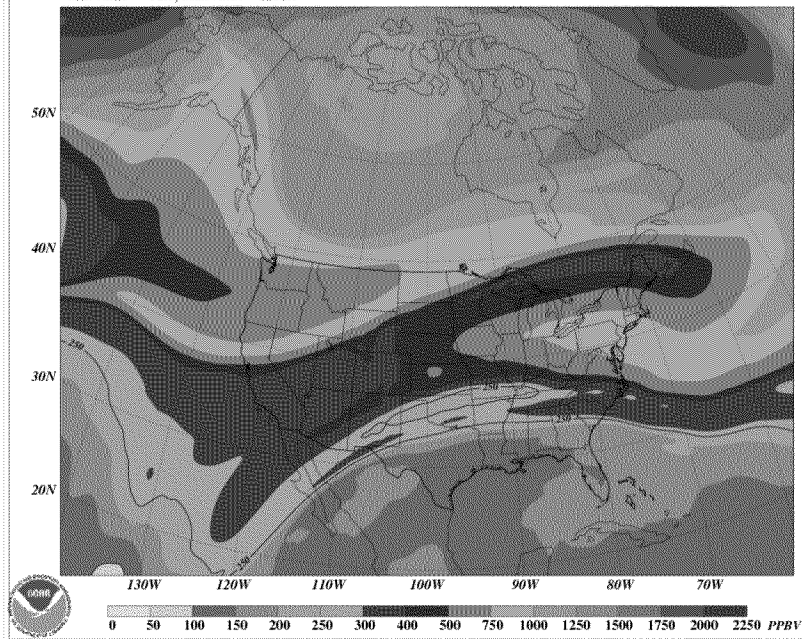




### GFS Ozone Mixing Ratio - 100 hPa

Min value = 52.7, Max value = 2252.1

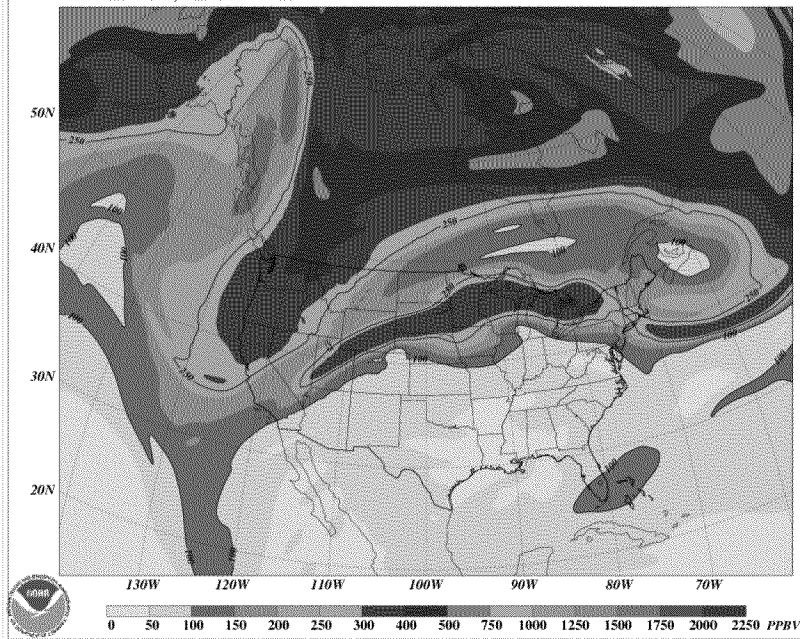
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### GFS Ozone Mixing Ratio - 200 hPa

Min value = 27.0, Max value = 896.4

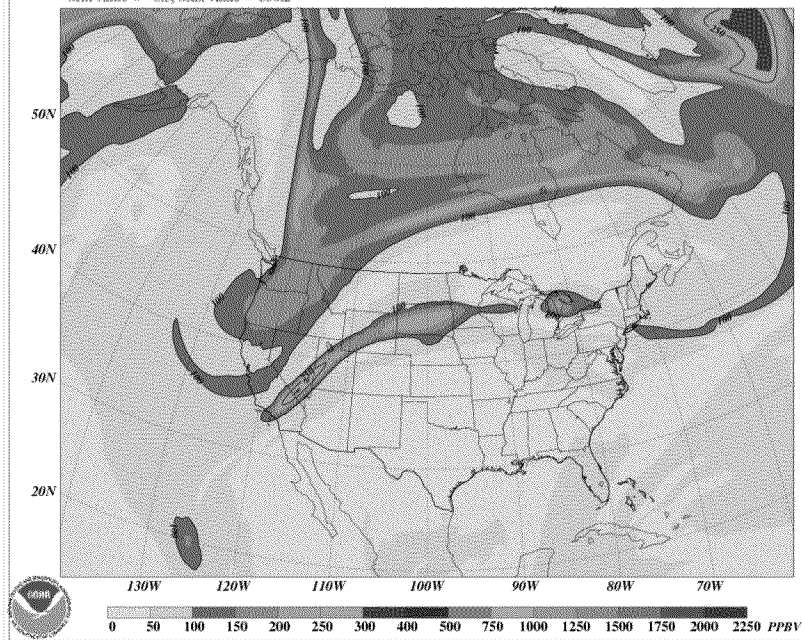
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### GFS Ozone Mixing Ratio - 300 hPa

Min value = 8.5, Max value = 350.2

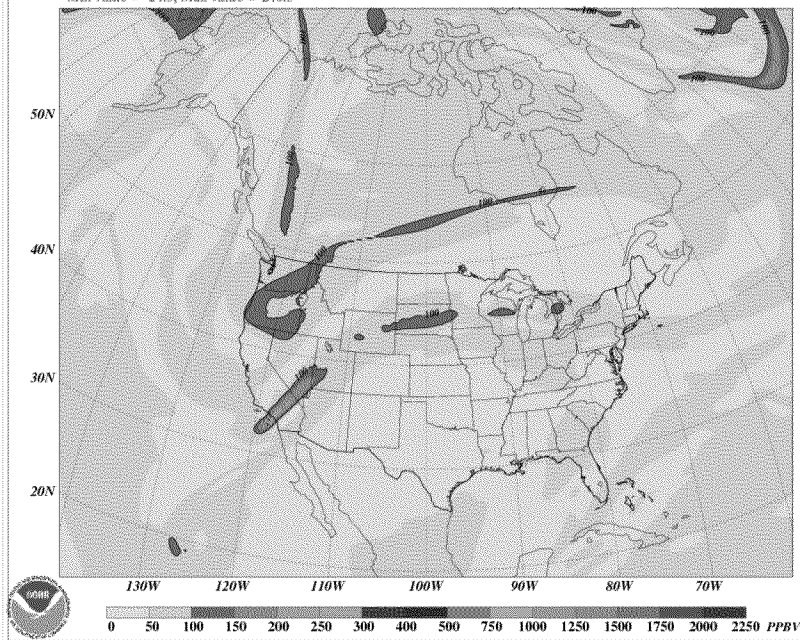
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### GFS Ozone Mixing Ratio - 400 hPa

Min value = 24.5, Max value = 240.5

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# Improvements

- Will be adding animation to cycle through forecasts.
- Would like feedback as to what improvements would be useful to your efforts.
  - Other
    - Variables
    - Pressure levels
    - Time resolution
    - Cross sections through SI
- Questions?